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THE PARANDRA BORER AS AN ORCHARD ENEMY.

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INTRODUCTION.

During the past few years the larva of a medium-sized brown beetle, *Parandra brunnea* Fab., has attracted considerable attention as an enemy of trees of several widely separated species and of chestnut telephone and telegraph poles. The characteristic injury of the insect to trees is in the form of a multitude of tortuous larval galleries extending through a more or less restricted portion of the trunk or larger branches. The most destructive attacks usually occur in the trunk within a few feet from the ground, the work of the borers being followed quickly by the decay of the affected wood and frequently by the breaking down of the tree (Pl. I, fig. *a*) at the point of greatest injury. (Pl. I, fig. *b*.)

Cultivated fruit trees are often injured by this borer, old apple, pear, and cherry trees being especially liable to attack. Hollow bases and decaying areas and cavities in the trunk and the consequent breaking and falling of weakened trees under the pressure of wind and snow are conditions quite commonly due in a large measure to the work of this insect. Injury is especially noticeable to trees growing in sunny, exposed positions, and the insect seems to be rather more abundant about villages and cities than in country districts, although both the larvæ and adults are found in many dissimilar locations and under a variety of conditions.

Tree surgeons and other persons who attempt to save and rejuvenate fruit trees suffering from diseased and decaying trunks quite often encounter the Parandra borer and its work. In cleaning out

NOTE.—This bulletin describes the Parandra borer as an enemy of fruit trees, gives its history and distribution, and suggests methods of combating it. It will be of interest throughout the greater portion of the United States.

NOTE.—In Mr. Snyder's interesting article on this species as an enemy to chestnut telephone and telegraph poles (Bul. 94, Pt. I, Bur. Ent., U. S. Dept. Agr., 1910), the beetles are illustrated in Plate I, figure 1, and the male is shown as the larger of the two sexes. Mr. Snyder has discovered that this is an error and wishes us to add that the female is almost always larger, or at least as large as the male.

old cavities in the trunk or larger branches for the purpose of filling with some cement-like material, a practice which is growing in favor, the presence of this borer often forces the operator, in removing all unsound wood, to cut much deeper into the tree than would otherwise be necessary.

While trees of medium age are sometimes attacked, and old trees that have been somewhat neglected suffer most, the borers have also been reported as occurring in nursery stock. Many old orchards that have passed their prime, but are still capable of producing good and profitable crops of fruit, are hastened to their end by this insect.

In two or three specific instances the Parandra borer has been recorded as being injurious to fruit trees, and many cases have been reported of the collection of the parent beetle on or about orchard trees. It appears, however, that no recommendations as to remedial measures have been made, and it would seem that further information regarding the insect and its habits and possible methods of reducing or preventing its attacks should be available to fruit growers and owners of fruit-producing trees. For the foregoing reasons this brief account of the species is presented.

HISTORY AND DISTRIBUTION.

The Parandra borer has been referred to by previous writers as the "ash root-borer," "chestnut telephone-pole borer," and "heartwood borer." These names, while significant with regard to the habits of the insect, are regarded by the writer as being too restrictive in their meaning to be appropriate as common names, since the borer does not confine its attacks to ash roots, chestnut telephone poles, nor entirely to the heartwood of trees in which it feeds. In fact, it is a very general feeder, attacking the live and dead heartwood and sapwood of a great variety of trees, including pine, black walnut, hickory, willow, beech, chestnut, chinquapin, oak, elm, tulip, apple, pear, plum, wild and cultivated cherry, locust, Ailanthus, soft maple, basswood, and black ash.

The Parandra borer belongs to the Spondylidæ, a small family closely related to the Cerambycidæ which includes many of the wood-boring larvæ. The species was first described by Fabricius,[1] in the year 1798, and given the technical name which it still bears. In the year 1861 Dr. George H. Horn[2] made the following record: "The larva of this insect may be seen in almost every locality in which decaying wood may be found. It appears to prefer beechwood, at least I have always found greater numbers in that particular kind of wood." In 1880 the American Entomologist for the month of August acknowledged the receipt by Dr. C. V. Riley of larvæ of this

[1] Fabricius, J. C. Supplementum Entomologiæ Systematicæ, p. 49. Hafniæ, 1798. *Tenebrio brunneus.*

[2] Horn, G. H. Observations on the habits of some coleopterous larvæ and pupæ. *In* Proc. Ent. Soc. Phila., v. 1, p. 43–44, Sept., 1861; p. 43, *Parandra brunnea* (Fabr.).

species, taken from black ash by Mr. Shelby Reed, Scottsville, N. Y. Various other writers give brief notes on the larvæ and adults as occurring in and about different species of forest trees, but it was not until the year 1890 that a note was published by Dr. F. H. Chittenden [1] of the Bureau of Entomology, associating the species with a cultivated fruit tree. In this note the author states: "found under the bark of domestic cherry; are very common." Mr. Thos. E. Snyder,[2] in 1910, writes that it has been determined that this beetle damages many species of living forest, fruit, and shade trees. In 1911, Mr. Charles A. Hart [3] published an account of this species in which he described the damage done to apple and other trees.

The insect has been found in Ontario, Canada, and in the States of Connecticut, New York, New Jersey, Pennsylvania, Illinois, Minnesota, Maryland, Virginia, West Virginia, Arkansas, Texas, Arizona, and California, and in the District of Columbia. There is little doubt that it may be found over the greater part of temperate North America.

CHARACTER OF INJURY.

The Parandra borer is one of several species of borers from which trees are in very little danger of injury so long as they are kept in sound and vigorous condition. The borers of the present species enter the wood from dead or decaying places on the surface (Pl. II, figs. *a*, *b*) and are probably never found in trees whose trunks and larger branches are entirely covered with healthy bark. Any accident or condition that will produce dead or decaying surface areas, especially about the base of the trunk, may result in a severe infestation by this borer, and, ultimately, in the loss of the tree. (Pl. I, fig. *a*.) Bruises on the trunk made by singletrees or farm tools; cavities resulting from improper pruning; areas killed by winter injury, sun scald, fire blight, collar rot, flatheaded borers (*Chrysobothris femorata* Fab.) and roundheaded borers (*Saperda candida* Fab.) are some of the primary injuries that may result in attacks by the Parandra borer.

When a tree is first attacked the beetles insert their eggs into the surface wood of the dead spots, usually after more or less decay has progressed, and the larvæ or borers extend their burrows throughout the adjacent heartwood and occasionally into the surrounding live sapwood. The borers mine throughout the wood for a period of probably three years, extending their galleries upward more frequently than downward, and finally transform to beetles within the

[1] Packard, A. S. Fifth Report of the U. S. Entomological Commission. Washington, 1890. P. 223. "*Parandra brunnea* Fabr. Under bark. (Chittenden.)"; p. 530, "Found under bark of domestic cherry, are very common."

[2] Snyder, T. E. Damage to chestnut telephone and telegraph poles by wood-boring insects. U. S. Dept. Agr., Bur. Ent., Bul. 94, Pt. I, p. 6, Dec. 31, 1910.

[3] Hart, C. A. The heart-wood borer (*Parandra brunnea* Fabr.). *In* 26th Rpt. Ill. State Ent., p. 68-73, figs. 5, 1911.

wood. These beetles work their way out through the larval galleries or gnaw through the dead wood to the surface and escape. They return frequently to the dead wood, however, and spend much time hiding in secluded spaces, such as old galleries, within the injured tree. Eggs are now inserted into the wood that forms the walls of the old burrows (Pl. III, figs. *a*, *b*), and the borers of the new brood penetrate still farther into the wood. Other insects and fungi soon appear to accelerate decay, and within a few years that particular part of the tree will consist merely of a thin shell of sound wood surrounding a decomposed heart. A tree so affected may continue to live but will be in danger of falling under a load of fruit or during a storm at any time. The period of usefulness and the lives of many old trees too often terminate in this way.

The work of the Parandra borer is sometimes confused with that of the roundheaded apple-tree borer, but a little knowledge of the habits of the two species will enable anyone to distinguish quite readily between them. The two borers bear a general superficial resemblance to each other, but the differences in their methods of attacking trees are distinct. The Parandra borer enters at a dead spot or cavity and throws no castings to the surface, whereas the roundheaded apple-tree borer enters living wood and freely extrudes reddish-yellow castings, which form in small heaps at the base of the infested tree. The different positions habitually occupied in the tree by the two borers will serve as a better means of identification than any characters possessed by either while in the larval stage. The Parandra borer is slightly more slender and has three pairs of small but rather distinct thoracic legs, while the roundheaded apple-tree borer is legless. The adults of the two species are totally unlike in appearance.

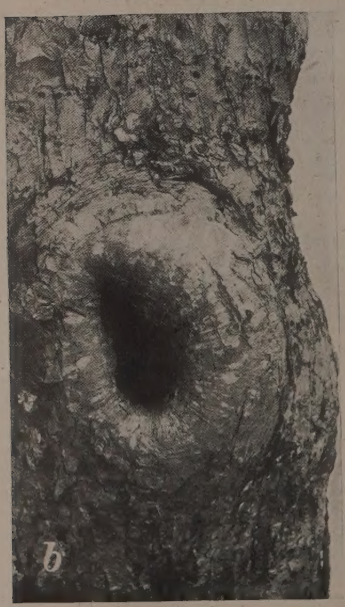
LIFE HISTORY.

The adult Parandra borer (Pl. IV, fig. *a*) is a somewhat flattened, glossy, chestnut-brown beetle which is rather variable in size but averages slightly less than three-fourths of an inch in length. The beetles appear on the wing in July and August, the time depending considerably on the latitude. At French Creek, W. Va., the writer found that pupation took place during the last days of June and first days of July in the years 1913 and 1914, and that the adult stage was reached before the 1st of August by each of about 50 individuals kept under observation during that period. The adults remain in the pupal chamber for a week or 10 days and may then continue to stay within the decaying wood of the host tree for a further period before taking flight.

Egg laying begins soon after the beetles quit the pupal chamber. In placing her eggs the female makes small punctures in the wood, probably by the use of both her mandibles and ovipositor. These

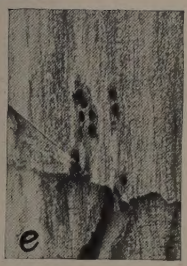
WORK OF THE PARANDRA BORER (PARANDRA BRUNNEA).

FIG. *a*.—Old apple tree broken in storm as a result of injury to the heart by Parandra borers.
FIG. *b*.—Apple tree with heartwood and sapwood honeycombed by Parandra borers. (Original.)



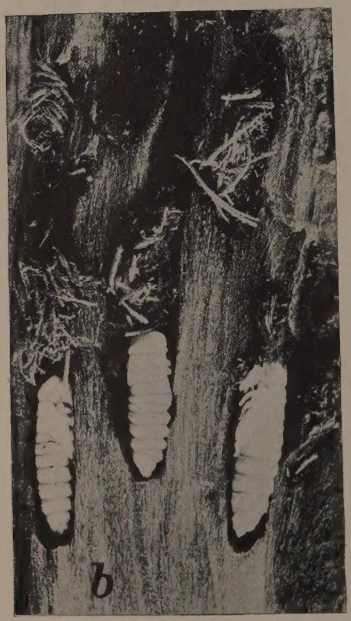
ORCHARD CONDITIONS FAVORING THE PARANDRA BORER AND REMEDY.

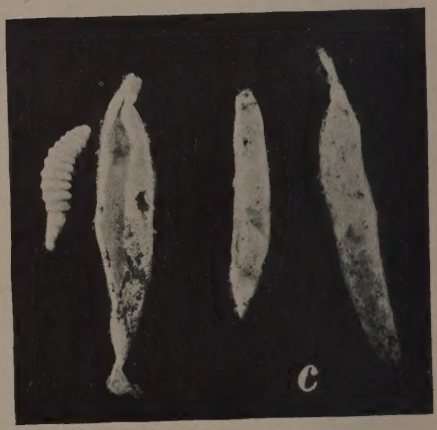
FIG. *a*.—Section of apple trunk showing favorite place of entrance for Parandra borers. FIG. *b*.—Cavity in trunk of apple tree, formed by the decaying of a dead limb; suitable place for Parandra beetles to deposit eggs. FIG. *c*.—Cavity shown in *b* cleaned out preparatory to filling with cement. (Original.)



STAGES OF THE PARANDRA BORER.

FIG. *a*.—Egg of the Parandra borer in natural position. Natural size. FIG. *b*.—Eggs of Parandra borer in natural position in the wood of apple. Much enlarged. FIG. *c*.—Parandra borers; variety of sizes to be found in an infested tree at any one time. Natural size. FIG. *d*.—Parandra borers working into heart of apple tree from old wounds made by the roundheaded apple-tree borer, *Saperda candida*. FIG. *e*.—Group of galleries made by young Parandra borers just after leaving the egg. Natural size. (Original.)





STAGES OF THE PARANDRA BORER AND ITS PARASITE.

FIG. *a*.—Adults of the Parandra borer. Much enlarged. FIG. *b*.—Pupæ of *Parandra brunnea* in natural position in wood of apple tree. Natural size. FIG. *c*.—Larva and cocoons of *Odontomerus mellipes*, a parasite of the Parandra borer. Natural size. (Original.)

punctures are about 2 mm. deep by 1–2 mm. wide, and a single egg is placed in each. (Pl. III, fig. *a*.) After the egg is inserted the mouth of the puncture is closed with fine particles of wood. Eggs are deposited in this manner in groups of a dozen or less, placed close together, in either the solid or somewhat decayed wood which forms the walls of larval galleries or other openings in the tree where the beetles can enter. When trees are first attacked the eggs are probably inserted from the surface into the wood of dead areas.

The egg (Pl. III, fig. *b*) is 1.5 mm. long by 0.5 mm. wide, oblong-ovate, and creamy white. The surface is slightly granular. Eggs hatch in two or three weeks, the time not having been definitely determined.

As soon as the larva or borer (Pl. III, fig. *c*) hatches, it begins to feed away from the original position occupied by the egg and extends its gallery in a zigzag course through the wood (Pl. III, fig. *e*). With the exception of the head, which is black, the borer is yellowish white, but the body contents when feeding in dark-colored wood give it a darker appearance. When full grown the larva attains a length of about 1¼ inches. It grows slowly and probably remains in the tree for at least three years before changing to the beetle, although this point in the insect's life history has never been fully determined.

The galleries are packed throughout their length with dustlike particles of wood that have passed through the digestive canal of the borer. These galleries wind about in every direction and are usually so numerous as to honeycomb the wood of the affected part of the tree. (Pl. I, fig. *d*.) A single burrow may be several feet in length, but its course is so tortuous that it seldom extends at any point more than a foot away from the place where the egg was deposited. The usual general course is more or less directly into sound wood from a place that is beginning to decay. This results in a rapid enlargement of the area of decay and in the continuous extension of the infested area with the appearance of each successive generation of borers. In many infested trees examined by the writer the Parandra borer was found to have been the first agency to open the way for the spread of decay into heartwood. Other insects follow but less frequently precede them in their attacks on the heartwood of fruit trees.

When the larva is ready to pupate it excavates a cell at the terminus of its burrow in the heartwood large enough to accommodate its body. Within this cell it transforms to the pupal stage (Pl. IV, fig. *b*). The burrow is packed for a short distance next to the cell with coarse, stringlike fragments of wood. This excelsior-like material forms the bed on which the pupa reposes and is evidently provided to insure the drainage of any moisture that might otherwise

collect about the insect during the inactive period of pupation. The pupal stage is from 10 days to 2 weeks in duration.

As has been stated (p. 4) the adults appear in July and August. The writer's observations indicate that the beetles are rather short lived, although Snyder [1] believes that oviposition may continue from August to October, and Hart [2] mentions a specimen collected in Illinois on September 25. The beetles are somewhat sluggish and fly at twilight, perhaps extending their activities throughout the night.

NATURAL ENEMIES.

In the year 1880 Riley [3] mentioned an ichneumon fly belonging to the genus Pimpla as parasitic upon the borers of this species. The writer has found the hymenopterous parasite, *Odontomerus mellipes* Say[4] (Pl. IV, fig. *c*), attacking the Parandra borer in West Virginia. This latter parasite destroys the borer and then constructs an elongate cocoon of white silk within the burrow of the host, in which it changes to the adult form.

The Biological Survey has found this beetle in the stomach of the olive-sided flycatcher (*Nuttallornis borealis*).

REMEDIAL MEASURES.

The first and most important consideration relative to preventing injury to trees by the Parandra borer is the keeping of the trees in such a condition of soundness that the beetles will not deposit eggs in them. As has been pointed out (p. 3), the entrance of the borer into the tree is first made at some point where dead wood is exposed by the removal or decay of bark as a result of some mechanical injury or disease. If exposed dead surfaces can be prevented, the danger of attacks from this borer will be eliminated. Injury to the trunks or larger branches of fruit trees, affording favorable places for borer attack, result from a variety of causes, some of which at least are easily preventable. The practice which is not uncommon of leaving stubs 6 inches or more in length in pruning out large branches is quite likely to result ultimately in injury from this insect. The stubs left are practically sure to die back to the trunk and form a decayed spot or cavity that is exactly to the liking of the beetle as a place in which to oviposit. (Pl. II, figs. *a*, *b*.) Instead of leaving such stubs when removing large branches, the cut should be made near to the trunk where the natural swell at the base of the branch will insure healing to be most rapid. The cut surface should then be covered with a heavy coat of white lead or some similar paint.

[1] Snyder, T. E. Damage to chestnut telephone and telegraph poles by wood-boring insects. U. S. Dept. Agr., Bur. Ent. Bul. 94, Pt. I, p. 3, Dec. 31, 1910.

[2] Hart, C. A. The heartwood borer (*Parandra brunnea* Fabr.) *In* 26th Rpt. Ill. State Ent., p. 72, 1911.

[3] Riley, C. V. Ash-root borer: Supposed eggs of *Odontota*. *In* Amer. Ent., v. 3 (new ser., v. 1), no. 8, p. 202, August, 1880.

[4] Specimens of this parasite were very kindly determined by Mr. J. C. Crawford, of the U. S. National Museum.

Another common place of entrance for the Parandra borer is near the surface of the ground where injury has been done some time previous by the common roundheaded apple-tree borer.[1] (Pl. III, fig. *d*.) Such injuries by roundheaded borers often persist as unhealed wounds and are always a source of danger to the tree. If the roundheaded borers are found and removed while they are yet small, the wounds made by them will heal quickly and no danger from attack by Parandra borers will follow. Injuries to the trunks of trees by tools in the hands of careless workmen are possible places for future attacks by Parandra borers and should, of course, be avoided wherever possible. Where such injuries occur they should be cleaned of torn and splintered bark and wood and the surface thoroughly painted.

Winter injuries and diseases attacking the trunk are less easily preventable, but where these are present Parandra borers may be kept out at least temporarily by a liberal use of paint applied to the dead surfaces. Paints so used should be renewed as often as once a year, and the applications may well be made in the spring or early summer.

Whenever borers of this species gain entrance to a tree there is only one practicable way of removing them, and that is to gouge or chisel out all the wood through which their burrows extend. (Pl. II, fig. *c*.) The cavity should then be properly cleaned and disinfected and filled with cement. Wherever the borers are present at all they are likely to occur in considerable numbers, and it is their habit in feeding to scatter about through the wood so much that little can be accomplished by attempting to remove them with a knife and wire, as is often done with some other species of fruit-tree borers.

In chiseling out the borers preparatory to using cement, all the punctured wood and all the wood soaked with water or affected by decay or disease should be removed. The interior of the cavity should then be sterilized by applying creosote with a brush, after which it should be painted with a heavy coat of coal tar. The cavity should then be filled compactly with a mortar made of one part of a good grade of Portland cement and three parts of clean, sharp sand.[2]

Trees treated thoroughly in this manner will be practically safe against Parandra borers until new places of attack are formed. However, it is less expensive and more satisfactory in every way to keep trees so far as possible in such a condition of soundness that the borers will find no place to enter.

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[1] *Saperda candida*. It is interesting in this connection to note that Dr. F. H. Chittenden, of the U. S. Department of Agriculture, found Parandra borers working on a linden tree on the grounds of the U. S. Department of Agriculture on April 27, 1909, that had apparently entered the tree at a point previously injured by *Saperda vestita*.

[2] Collins, J. F. Practical tree surgery. *In* U. S. Department of Agriculture Yearbook for 1913, p. 163–190, pl. 16–22, 1914. Contains excellent directions for the use of cement in trees.